Andreev reflection in spin-polarized transport through an interacting quantum dot in a hybrid tunneling junction

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Spin-dependent tunneling through a quantum dot coupled to one ferromagnetic and one superconducting electrodes is studied in the Andreev reflection (AR) regime. Electrical conductance is calculated within the nonequilibrium Green function technique. Effects due to a competition between the Coulomb correlations on the dot, intradot spin-flip processes and Zeeman splitting of the dot discrete level are analyzed in both linear and nonlinear transport regimes. Moreover, the AR phenomenon is studied for different coupling strengths of the dot to the external electrodes and for different magnetizations of the ferromagnetic electrode. It is shown that when a coherent spin rotation is present on the dot, Coulomb interactions may lead to a significant enhancement of the AR tunneling current. A new interference effect due to AR is predicted to appear in the case of a weak intradot repulsion. By contrast, strong Coulomb correlations studied in nonequilibrium situation revealed significant modifications of the AR differential conductance which occurs only in case of spin-polarized transmission. New conditions of the matching of Fermi velocity leading to the perfect AR transmission are formulated in the context of arbitrary Coulomb correlations on the dot. Origin of occurrence of a variety of the multipeak structure of the conductance in equilibrium as well as in nonequilibrium situation is also discussed in detail.